



QD-SS-008
REVISION D

Effective Date: September 24, 2004

ORGANIZATIONAL INSTRUCTION

Pyrotechnic Device Safety and Mission Assurance

OPR(s)

OPR DESIGNEE

**QD10, QD20,
QD30, and QD40**

Steve Reed

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DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		11/20/97	
Revision	A	7/1/99	Changes made to reflect new organization code changes and/or Changes made to reflect new directives renumbering scheme
Revision	B	9/09/02	Format and numbering change to implement requirements of QS-A-001 rev F.
Revision	C	05/12/04	Changes made to reflect new responsibilities of S&MA Office pyrotechnic personnel
Revision	D	09/24/04	Revised to bring document in compliance with the HQ Rules Review Action (CAITS: 04-DA01-0387). Changes were also made to reflect S&MA organizational name changes (e.g., QS to QD).

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Pyrotechnic Device Safety and Mission Assurance

1. SCOPE

1.1 Scope. This procedure shall apply to all Safety and Mission Assurance (S&MA) functions performed for MSFC-managed pyrotechnic devices and systems by the MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems, and all delegated personnel performing such functions under cognizance of the S&MA Directorate Technical Expert for Pyrotechnic Systems. These functions are performed at MSFC, other NASA Centers, prime contractor facilities, and subcontractor facilities, as appropriate.

1.2 Purpose. The purpose of this procedure is to provide guidance and instructions for performance of S&MA functions associated with all MSFC-managed pyrotechnic devices and systems.

1.3 Applicability. This procedure shall apply to all S&MA functions performed for MSFC-managed pyrotechnic devices and systems.

2. APPLICABLE DOCUMENTS

- a. NSTS 08060, Space Shuttle System Pyrotechnic Specification
- b. NSTS 5300.4 (1D-2), Safety, Reliability, Maintainability and Quality Provisions for the Space Shuttle Program
- c. NSTS 1700.7B, Safety Policy and Requirements For Payloads Using the Space Transportation System
- d. MSFC-STD-1800, Electrostatic Discharge (ESD) Control for Propellant and Explosive Devices

3. DEFINITIONS

The following definitions of terms commonly used in discussions of pyrotechnic devices are included to assist in understanding technical requirements of Applicable Documents listed in paragraph 2.

- a. **Deflagration**-A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to proceed and be accelerated without input of heat from another source. This is a surface phenomenon with the reaction proceeding towards the unreacted material along the surface at subsonic velocity. The effect of a true deflagration under confinement is an explosion.

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Confinement of the reaction increases pressure, rate of reaction, and temperature, and may cause transition into a detonation.

b. **Detonation**-A violent chemical reaction within a chemical compound or mechanical mixture involving heat and pressure. This is a reaction which proceeds through the reacted material toward the unreacted material at a supersonic velocity. The result of the chemical reaction is exertion of extremely high pressure on the surrounding medium forming a propagating shock wave which is originally of supersonic velocity.

c. **Electroexplosive Device**-Any device which uses a difference in electrical potential to initiate an explosive reaction.

d. **Explosive**-Any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, detonation, or other suitable initiation, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases. This term applies to materials that either detonate or deflagrate.

e. **Propellant**-Any substance or combination of substances, liquid or solid, that when ignited, propels or provides thrust through a deflagration reaction. A propellant is an explosive that is suitable for effecting the controlled propulsion of a solid body.

f. **Pyrotechnic Device**-Any item or device containing explosive or chemical ingredients, including powdered metals, that is capable of deflagration or detonation.

4. INSTRUCTIONS/PROCEDURE

The following functions shall be performed by the MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems or, when appropriate, by other suitably qualified personnel (hereafter referred to as other delegated personnel) under direct cognizance of the MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems. Other delegated personnel may include mission services contractor personnel and Defense Contract Management Agency (DCMA) personnel. Performance of these functions shall be fully compliant with the requirements of NSTS 08060, NSTS 5300.4(1D-2), NSTS 1700.7B, and MSFC-STD-1800, as appropriate.

4.1 Design Reviews. The MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall participate in all Preliminary Design Reviews and Critical Design Reviews for Space Shuttle pyrotechnic devices. At the request of the appropriate MSFC Project Office, the S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall participate in Preliminary Design Reviews and Critical Design Reviews for Space Shuttle Payload, Upper Stage, Expendable Launch Vehicle, Reusable Launch Vehicle, and other designated pyrotechnic devices.

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4.2 Baseline Reviews. The MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall participate in all Baseline Reviews for Space Shuttle pyrotechnic devices, as required by NSTS 08060. When requested by the appropriate MSFC Project Office, the S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall participate in Baseline Reviews for Space Shuttle Payload, Upper Stage, Expendable Launch Vehicle, Reusable Launch Vehicle, and other designated pyrotechnic devices.

4.3 Pre-Production Reviews. The MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall participate in all Pre-Production Reviews for Space Shuttle pyrotechnic devices, as required by NSTS 08060. At the request of the appropriate MSFC Project Office, the S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall participate in Pre-Production Reviews for Space Shuttle Payload, Upper Stage, Expendable Launch Vehicle, Reusable Launch Vehicle, and other designated pyrotechnic devices.

4.4 Flight Certification Reviews. The MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall participate in all Flight Certification Reviews for Space Shuttle pyrotechnic devices, as required by NSTS 08060. NASA Quality Assurance signature authority for Lot Certificates shall be vested solely in the MSFC S&MA Office Technical Expert for Pyrotechnic Systems. When the MSFC S&MA Office Technical Expert for Pyrotechnic Systems is unavailable to sign a Lot Certificate, signature by S&MA Directorate management personnel or other delegated personnel is permissible, provided that this action has the concurrence of the MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems and is so noted on the Lot Certificate. When requested by the appropriate MSFC Project Office, the S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall participate in Flight Certification Reviews or other acceptance reviews for Space Shuttle Payload, Upper Stage, Expendable Launch Vehicle, Reusable Launch Vehicle, and other designated pyrotechnic devices.

4.5 Failure Investigations. The MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems shall participate in all failure investigations involving Space Shuttle pyrotechnic devices used for flight, qualification testing, and lot acceptance testing. At the request of the appropriate MSFC Project Office, the S&MA Directorate Technical Expert for Pyrotechnic Systems shall participate in failure investigations for Space Shuttle Payload, Upper Stage, Expendable Launch Vehicle, Reusable Launch Vehicle, and other designated pyrotechnic devices.

4.6 Material Review and Configuration Control Boards. The MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems or other delegated personnel shall evaluate pyrotechnic device nonconformance reports, problem reports, deviation/waiver requests, engineering change requests, engineering change proposals, contract change proposals, specifications, manufacturing procedures, inspection requirements, and test procedures in support of Configuration Control Board and Material Review Board activities.

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4.7 Shuttle Pyrotechnics Working Group. The MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems shall serve as a member of the Shuttle Pyrotechnics Working Group (NASA Level II Steering Committee for Space Shuttle Pyrotechnic Policy). This function shall not be delegated.

5. NOTES

Directive Replacement. This Directive replaces S&MA QS10-SS-008, Pyrotechnic Device Safety and Mission Assurance.

6. SAFETY PRECAUTIONS AND WARNING NOTES

Not applicable.

7. APPENDICES, DATA, REPORTS, AND FORMS

Not applicable.

8. RECORDS

Not applicable.

9. TOOLS, EQUIPMENT, AND MATERIALS

Not applicable.

10. PERSONNEL QUALIFICATIONS

Other delegated personnel, as defined in paragraph 4, shall have the following pyrotechnic experience and training, as a minimum, before performing any of the pyrotechnic device S&MA functions governed by this document:

- a. A combination of pyrotechnic experience and training totaling at least ten years, a minimum five years of which shall involve NASA pyrotechnic devices. This experience and training shall be in pyrotechnic device quality engineering, quality assurance, inspection, test, or design engineering. Formal classroom instruction and on-the-job training in appropriate pyrotechnic disciplines are considered qualifying training for purposes of satisfying this requirement.
- b. Classroom instruction in radiography. Formal radiography certification is not required.
- c. On-the-job training in evaluation and interpretation of pyrotechnic device x-rays and neutron radiographs. This training shall be provided by the MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems during Flight Certification Reviews.

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d. On-the-job training in proper performance of Flight Certification Reviews. This training shall be provided by the MSFC S&MA Directorate Technical Expert for Pyrotechnic Systems during actual Flight Certification Reviews for MSFC-managed pyrotechnic devices.

11. FLOW DIAGRAM

Not applicable.